

CLAIMS

We Claim:

- 1 1. A light generating device comprising:
2 a light emitting device; and,
3 an epoxy placed over the light emitting device, the epoxy including:
4 a first type of phosphor, and
5 a second type of phosphor;
6 wherein the first type of phosphor, when excited, emits light of a first
7 color;
8 wherein the second type of phosphor, when excited, emits light of a
9 second color; and,
10 wherein the first color and the second color are different.

- 1 2. A light generating device as in claim 1 wherein the light emitting
2 device is a blue light emitting diode, wherein the first type of phosphor is a
3 green phosphor, and wherein the second type of phosphor is a yellow phosphor.

- 1 3. A light generating device as in claim 1:
2 wherein the light emitting device is a blue light emitting diode;
3 wherein the first type of phosphor is one of the following:
4 Strontium Thiogallate:Europium, having a chemical formula of
5 $\text{SrGa}_2\text{S}_4:\text{Eu}$,

6 a thiogallate phosphor that is a mix group II alkaline metal
7 thiogallate phosphor (Sr,Ca,Ba)(Al,Ga)₂S₄:Eu; BaSrGa₄S₇:Eu; and,
8 wherein the second type of phosphor is a yellow phosphor having one of
9 the following chemical formulas:

10 Tb₃Al₅O₁₂:Ce,
11 Sr(Ba,Ca)SiO₄:Eu,
12 YAG:Ce.

1 4. A light generating device as in claim 1 additionally comprises one of
2 the following:

3 a mold compound covering the epoxy;
4 an optical dome covering the epoxy.

1 5. A light generating device as in claim 1 wherein the first type of
2 phosphor is a red phosphor, and wherein the second type of phosphor is a
3 yellow phosphor.

1 6. A light generating device as in claim 1:
2 wherein the first type of phosphor is a red phosphor having one of the
3 following chemical formulas:

4 CaS:Eu²⁺,Mn²⁺,
5 SrS:Eu²⁺,
6 (Zn,Cd)S:Ag⁺,

Mg₄GeO_{5.5}F:Mn⁴⁺,
ZnS: Cu⁺,
ZnSe:Cu, Cl,
ZnSe_{1/2}Si_{1/2}:Cu,Cl,
BaSi₇N₁₀:Eu²⁺,
(Ca,Sr,Ba)Si₅N₈:Eu²⁺; and,

wherein the second type of phosphor is a yellow phosphor having one of the following chemical formulas:

Tb₃Al₅O₁₂:Ce,
Sr(Ba,Ca)SiO₄:Eu,
YAG:Ce.

7. A light generating device as in claim 1 additionally comprising:
a second light emitting device; and,
a second epoxy placed over the second light emitting device, the second epoxy including:
the first type of phosphor, and
the second type of phosphor.

8. A light generating device as in claim 1 additionally comprising:
a second light emitting device;
a second epoxy placed over the second light emitting device, the second epoxy including:

5 the first type of phosphor, and
6 the second type of phosphor;
7 a third light emitting device; and,
8 a third epoxy placed over the third light emitting device, the third epoxy
9 including:

10 the first type of phosphor, and
11 the second type of phosphor.

1 9. A light generating device as in claim 1, wherein the light emitting
2 device is mounted on one of the following:

3 a printed circuit board;
4 a lead frame.

1 10. A light generating device as in claim 1, wherein the light emitting
2 device is mounted within a printed circuit board substrate.

1 11. A method for generating colored light comprising:
2 emitting light from a light emitting device; and,
3 combining light emitted from light emitting device with light from a first
4 type of phosphor and a second type of phosphor, the first type of phosphor and
5 the second type of phosphor being within an epoxy placed over the light
6 emitting device, wherein the first type of phosphor, when excited, emits light of

7 a first color, wherein the second type of phosphor, when excited, emits light of a
8 second color, and wherein the first color and the second color are different.

1 12. A method as in claim 11 wherein the light emitting device is a blue
2 light emitting diode, wherein the first type of phosphor is a green phosphor,
3 and wherein the second type of phosphor is a yellow phosphor.

1 13. A method as in claim 11:

2 wherein the light emitting device is a blue light emitting diode;

3 wherein the first type of phosphor is one of the following:

4 Strontium Thiogallate:Europium, having a chemical formula of
5 $\text{SrGa}_2\text{S}_4:\text{Eu}$;

6 a thiogallate phosphor that is a mix group II alkaline metal
7 thiogallate phosphor $(\text{Sr}, \text{Ca}, \text{Ba})(\text{Al}, \text{Ga})_2\text{S}_4:\text{Eu}$; $\text{BaSrGa}_4\text{S}_7:\text{Eu}$; and,

8 wherein the second type of phosphor is a yellow phosphor having one of
9 the following chemical formulas:

10 $\text{Tb}_3\text{Al}_5\text{O}_{12}:\text{Ce}$,

11 $\text{Sr}(\text{Ba}, \text{Ca})\text{SiO}_4:\text{Eu}$,

12 $\text{YAG}:\text{Ce}$.

1 14. A light generating device comprising:

2 an emitting means for emitting light; and,

3 an holding means for holding a first type of phosphor and a second type
4 of phosphor adjacent to the emitting means;
5 wherein the first type of phosphor, when excited, emits light of a first
6 color;
7 wherein the second type of phosphor, when excited, emits light of a
8 second color; and,
9 wherein the first color and the second color are different.

1 15. A light generating device as in claim 14 wherein the emitting means is
2 a blue light emitting diode, wherein the first type of phosphor is a green
3 phosphor, and wherein the second type of phosphor is a yellow phosphor.

1 16. A light generating device as in claim 14:
2 wherein the emitting means is a blue light emitting diode;
3 wherein the first type of phosphor is one of the following:
4 Strontium Thiogallate:Europium, having a chemical formula of
5 $\text{SrGa}_2\text{S}_4:\text{Eu}$;
6 a thiogallate phosphor that is a mix group II alkaline metal
7 thiogallate phosphor $(\text{Sr},\text{Ca},\text{Ba})(\text{Al},\text{Ga})_2\text{S}_4:\text{Eu}$; $\text{BaSrGa}_4\text{S}_7:\text{Eu}$; and,
8 wherein the second type of phosphor is a yellow phosphor having one of
9 the following chemical formulas:
10 $\text{Tb}_3\text{Al}_5\text{O}_{12}:\text{Ce}$,
11 $\text{Sr}(\text{Ba},\text{Ca})\text{SiO}_4:\text{Eu}$,

12 YAG:Ce.

1 17. A light generating device as in claim 16 wherein the first type of
2 phosphor is a red phosphor, and wherein the second type of phosphor is a
3 yellow phosphor.

1 18. A light generating device as in claim 16:
2 wherein the first type of phosphor is a red phosphor having one of the
3 following chemical formulas:

4 CaS:Eu²⁺,Mn²⁺,

5 SrS:Eu²⁺,

6 (Zn,Cd)S:Ag⁺,

7 Mg₄GeO_{5.5}F:Mn⁴⁺,

8 ZnS: Cu⁺,

9 ZnSe:Cu, Cl

10 ZnSe_{1/2}Si_{1/2}:Cu,Cl,

11 BaSi₇N₁₀:Eu²⁺,

12 (Ca,Sr,Ba)Si₅N₈:Eu²⁺; and,

13 wherein the second type of phosphor is a yellow phosphor having one of
14 the following chemical formulas:

15 Tb₃Al₅O₁₂:Ce,

16 Sr(Ba,Ca)SiO₄:Eu,

17 YAG:Ce.

1 19. A light generating device as in claim 14, wherein the emitting means
2 is mounted on one of the following:
3 a printed circuit board;
4 a lead frame.

1 20. A light generating device as in claim 14, wherein the emitting means
2 is mounted within a printed circuit board substrate.